(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 411 932 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 90308483.8

(51) Int. Cl.5: G01N 1/08

(22) Date of filing: 01.08.90

(30) Priority: 02.08.89 GB 8917645
06.04.90 GB 9007893

(43) Date of publication of application:
06.02.91 Bulletin 91/06

(84) Designated Contracting States:
DE DK FR IT SE

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(54) Sampling probe.

(57) A pneumatic sampling probe for withdrawing a representative sample from bulk material (especially grain) into which the probe is inserted, comprising within an outer wall a channel for directing air at atmospheric pressure along the probe to its tip and thence back along the probe to an outlet for connection to a vacuum pump and to a store for the sample, in which the wall has an aperture upstream of and close to the tip exposing the channel to the exterior of the probe for the ingress of the sample, the bent portion of the channel between the aperture an the tip constituting an intermediate store for the material to be sampled.

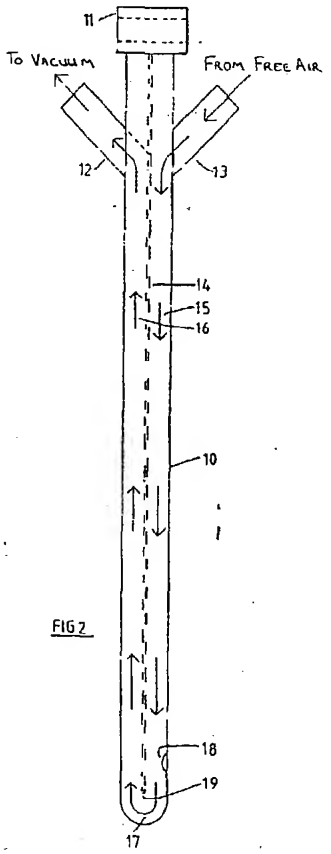

FIG 2

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SAMPLING PROBE

This invention relates to a sampling probe for extracting representative samples from bulk material, and to a method of doing so, and is especially useful in the sampling of powdered solid or granular materials, for example grain or flour, which may comprise a mixture of particles of different sizes including fine dust. The invention is particularly useful in the extraction of a sample obtained uniformly from each part of a vertical column of the bulk material.

Sampling probes in the form of spears, or triers as they are also known, are conventionally used in food grain sampling, where the careful monitoring of the condition of the grain is controlled by British Standards, and of seeds by Seed Regulations. It is important to obtain truly representative samples of the bulk material, yet this is difficult when the material comprises a mixture of different sized components ranging from dust to complete grains. Using a typical automatic vacuum-driven sampling spear consisting of a pointed tube with an aperture in the side wall near its tip, the percentage of dust by weight in a sample was 21% when the deliberate spike in the bulk material was 16.7%; using a typical hand-held spear, the percentage dust from the same bulk material was 11.4%. This magnitude of error is unacceptable, and the purpose of the invention, in one aspect, is to provide a sampling probe which takes a more representative sample.

The invention, in its first aspect, provides a pneumatic sampling probe for withdrawing a representative sample from bulk material into which the probe is inserted, comprising within an outer wall a channel for directing air along the probe to its tip and thence back along the probe to an outlet for connection to a vacuum pump and to a store for the sample, in which the wall has an aperture upstream of and close to the tip exposing the channel to the exterior of the probe for the ingress of the sample, the bent portion of the channel between the aperture and the tip constituting an intermediate store for the material to be sampled.

Conveniently, the aperture is removably covered by a collection member, eg a flap, which is positioned so as to scoop the material into the aperture from a column of the bulk material as the probe is moved vertically.

One example of such a probe has been found to take a much more representative sample of the bulk material referred to above, in which the percentage by weight of dust was 16.9%, i.e. the composition of components of different particle size in the samples it takes is accurate to a little over one percent. It is believed that this improvement is due to the manner in which the probe admits the sample; it allows the sample to enter through the aperture into the intermediate store, assisted by a small pressure difference which is limited by the presence of the intermediate store, and neither under gravity alone nor by direct suction. Thus there is no influence tending to select one particle size in favour of another: the aperture is preferably large in relation to the particle size for which the sampling probe is intended. Although the pressure is substantially lower at the outlet, the intermediate store of sample material is capable in use of acting as a buffer, so that the pressure experienced by the material as it is sucked from the intermediate store decreases smoothly from atmospheric pressure.

The invention, in a second aspect, also provides a method of withdrawing a representative sample from bulk material using a sampling probe according to the first aspect of the invention described above, comprising inserting the probe downwardly tip first into the material, allowing the material to flow under gravity through the aperture into the intermediate store, and simultaneously sucking air and the sampled material from the outlet while allowing air into the upstream section of the channel.

From a third aspect, the invention provides a method of withdrawing a representative sample from bulk material using a sampling probe having a channel for the passage of air and an aperture exposing part of the channel to the exterior, comprising inserting the probe into the bulk material, allowing the material to flow under gravity through the aperture into an intermediate portion of the channel, allowing the material to collect in that intermediate portion to form an intermediate store across the whole channel, and simultaneously sucking air and the sampled material from the intermediate store through the channel downstream of the aperture.

In a forth aspect, the invention provides a method of withdrawing a representative sample from bulk materials using a pneumatic sampling probe having a channel for the passage of air and an aperture exposing part of the channel to the exterior, comprising inserting the probe into the bulk material and withdrawing it therefrom, and allowing the sample to enter the aperture whilst the probe is moving steadily downwards and/or upwards, simultaneously maintaining a very small pressure difference across the aperture.

Conventional hand probes for grain sampling, such as those described in US patent no. 2896444, comprise a spear-like body which is plunged into the bulk material, and a series of spaced apertures

for admitting samples into an inner collection chamber. Automated probes are also known, for example that disclosed in French Patent No 2542086, in which the sampled material is extracted from the probe by suction. Neither form of sampling apparatus takes a truly representative sample, and it is believed that this is at least partly because of the way in which the particles fall into the chamber; there is inherently a bias towards the collection of either larger or smaller particles. In the case of the hand-held probes of US-2896444, for example, it is believed that the particles fall in an irregular path inclined at about 45 degrees to the vertical probe axis, before they reach the apertures, and that this results in a higher grain-to-dust ratio in the sample than in the bulk material.

Moreover, conventional probes are suited only to specific types of bulk material, so that a range of probes is required.

It is important that a sample should be as representative as possible, and it would also be advantageous for a probe to be capable of use with a wide range of different bulk materials and mixtures.

Accordingly, the invention, in a fifth aspect, provides a sampling probe for bulk granular or powdered solid material, comprising an elongate body having a tip for facilitating insertion of the probe into the bulk material and having an internal storage chamber extending over a major portion of its length, and closed along one side by a shutter which is moveable lengthwise by means of an external drive, the shutter having a single aperture which opens the chamber to the bulk material at any one of a continuous range of positions along the full length of the chamber, such that steady movement of the shutter causes it to advance adjacent a column of the bulk material immediately adjacent and parallel to the shutter and to collect that column progressively in the chamber at a level corresponding to the level from which the material was collected.

Preferably, the probe includes a collection member connected to the shutter adjacent the edge of the aperture nearest the tip and moveable between an inoperative position, flush with the main surface of the shutter, and a sample collection position at which it projects transversely of the probe, such that movement of the shutter causes the collection member to advance through the said column of the bulk material, pushing it through the aperture and into the chamber at the corresponding level.

Preferably, the collection member closes the aperture at its inoperative position; it may be pivotable between its two positions. Preferably also, the collection member is shaped so as to adopt its inoperative position when the shutter moves towards the tip, and to adopt its collection position when the shutter moves the other way (in preparation for a sampling cycle).

The probe may be a hand probe, or else part of an automatic sampling station.

Thus the invention, in its sixth aspect, also provides a sampling probe for bulk granular or powdered solid material, comprising an elongate body having a tip for facilitating insertion of the probe into the bulk material and having an internal storage chamber extending over a major portion of its length, and closed along one side by a shutter which is moveable lengthwise by means of an external drive, the shutter having a single aperture which opens the chamber to the bulk material at any one of a continuous range of positions along the full length of the chamber, a collection/closure member connected to the shutter adjacent the edge of the aperture nearest the tip and pivotable between a closure position, at which it closes the aperture, and a collection position at which it projects transversely of the probe and is prevented from further movement outwardly of the probe body, the inclination of the collection/closure member at its collection position being such that insertion of the probe into the bulk material ensures closure of the collection/closure member, and the collection/closure member having a minor portion which still projects from the shutter at its closure position such that steady movement of the shutter from the end of the chamber nearer the tip to the opposite end ensures that the collection/closure member moves to its collection position and then collects progressively a column of the bulk material immediately adjacent and parallel to the shutter, the collected material being pushed by the collection/closure member through the aperture and into the chamber at a level corresponding to the level from which the material was collected.

Preferably, the collection/closure member is a flap hinged along the edge of the aperture, and pivotable through a limited angular range, from zero (its closure position) to between 30 degrees and 70 degrees, preferably about 45 degrees (its collection position). The shutter is conveniently an endless roller shutter extending in an elongate loop over both longitudinal sides of the chamber.

The external drive may be powered automatically or, in the case of a hand probe, it may a rotary drive using, for example, a crank handle. The chamber preferably has a permanent opening at its end remote from the tip, for the removal of sampled material, but this is not essential since the shutter could be positioned appropriately during removal.

The invention, in a seventh aspect, provides a pneumatic sampling system for fluid material such as granular material, comprising a vacuum pump

connected through a sampling channel to a sampling device and, intermediate the pump and the sampling device, a pressure control device comprising: An air chamber defined by a wall and having an air outlet connected to an inlet of the sampling channel, the wall having at least one opening to the atmosphere, the opening being capable of progressive closure by a closure member which is resiliently biased towards a first position at which the opening is unobstructed, and the closure member being responsive to a difference in pressure between the atmosphere and the chamber interior to move against such resilient bias towards a second position at which the opening is at least partially closed, causing a progressive closure of the opening, whereby the resistance to air flow from the atmosphere to the sampling channel inlet increases progressively with a decreasing air pressure in the sampling channel. In this way, any obstruction in the sampling device causes greater suction to be developed there, facilitating its clearance, but in the normal operation of the system the suction at the sampling device is just sufficient to convey the sample through the sampling channel. This feedback control helps to ensure that, where the sampling device has an aperture for receiving the sample from bulk material in which the device is immersed, the pressure difference across that aperture is kept very low, which, as indicated above, provides for a representative sample.

With each aspect of the invention as described above, the sampling system may be automatic, in which the motion of the sampling device (probe) and the extraction of the sample for analysis are performed under automatic control, or it may be manual.

Sampling systems embodying the invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a side elevation and Figure 2 is a front elevation of a sampling spear;

Figures 3 and 4 are front and side elevations, to an enlarged scale, of the lower portion of the spear of figures 1 and 2, with additional apparatus and with a differently-shaped aperture;

Fig 5. is a front elevation of a hand probe;

Fig 6. is a side elevation of the hand probe;

Fig 7. is a section on the line A - A of Fig 5;

Fig 8. is an alternative shape for the flap, in side elevation, of the hand probe; and

Fig 9. is a diagrammatic elevation of a pressure control device.

The sampling spear of figures 1 and 2 comprises a steel wall 10 about 2m long closed at both ends and terminating at its upper end at a bush 11 for connection to an arm of an automatic sampling station, or a lever for manual insertion. Its lower end is formed into a pointed tip 20 to ease its insertion into bulk material such as grain.

The spear is divided internally down a vertical cross section by a steel baffle plate 14 which extends from the top end 11 down to near the tip 20, separated from the tip by a distance of about half the width of the spear. This defines a U-shaped channel of generally uniform cross-section comprising upstream 15 and downstream 16 sections joined by a bent portion 17. An atmospheric air inlet tube 13 is connected to the upstream section 15 near the top, and an outlet tube 12 is connected to the downstream section 16 at the same point near the top.

An aperture 18 which may be of fixed size but is preferably of a size variable using an adjustable plate or otherwise, is formed in the side wall 10 upstream of the tip 20, upstream of the end of the baffle plate 19 by a distance of about the width of the channel. The aperture has an area of the same order as the cross-sectional area of the channel at that point. The portion of the channel beneath the aperture 18 and immediately beneath the end 10 of the baffle plate, i.e. the bent portion of the channel, constitutes an intermediate store for the material entering the aperture 18 when the spear is generally upright as shown.

The accuracy of sample collection may be further enhanced, especially when the bulk is a flowable material, by the addition of a flap 26 on side wall 10, as shown in figures 3 and 4, which is closed on descent through the bulk, but opens upon ascent to scoop material into the channel.

In the modified spear shown in figures 3 and 4, the flap 26 is hinged along its lower edge 28 to the channel 10 outer wall immediately below the aperture 18, which in this example is rectangular (optionally adjustable by a plate). The flap has an outwardly curved lip 29 which reacts against the bulk material to move the flap outwardly or inwardly depending on whether the spear is ascending or descending. Outward movement of the flap is limited by a bar 27, attached to the flap and projecting therefrom at each side, abutting against a pair of stop plates 21, 22 having circular apertures 25. The transverse position of the stop plates 21, 22 is adjustable by virtue of slots 23 whose edges are clamped by bolts 24, so that the bar 27 abuts a corresponding part of the inner edges of the circular apertures 25, determining the maximum angle of opening of the flap 26.

The outlet tube 12 is connected to a conventional vacuum pump and grain sampling store.

In use, the spear is pushed vertically downwards into the bulk grain, for example in a truck, until a major part is buried in the grain, ensuring that no grain enters the air inlet tube 13. Grain enters the channel through the aperture 18 due to the weight of the bulk material and the small pres-

sure difference between the bulk and the inside of the channel, and falls into the intermediate store 17.

At a predetermined instant, the vacuum pump is activated, causing a pressure drop of approximately one atmosphere to develop across the intermediate store 17. Grain mixed with air is sucked up the downstream portion 16 of the channel, and through the outlet 12 to the external sample store.

In one method, without the flap, the sample is withdrawn as the spear descends, sampling then terminating when it reaches full depth; alternatively, the sample is withdrawn as it ascends, especially if the flap 26 is fitted. For less flowable materials, the sample is withdrawn on descent and ascent. Another method is for a sample to be withdrawn at a selected level which may be the deepest level. The sample is stored automatically; the spear is withdrawn, then moved transversely to a different sampling point, and then caused to sample again in the same way.

It will be apparent that the configuration of the spear may be varied from that shown; it may have a tubular section with a diametric baffle plate, for example, or it may comprise coaxial annular channel sections. The aperture may have a different shape, or there may be more than one aperture; there may be a projection inwardly or, as with flap 26, outwardly from the aperture.

To assist in the maintenance of a low pressure difference between inside and outside of the channel whilst in the bulk, holes may be provided in the baffle plate 14, which may vary in size.

Further, it is envisaged that the spear could be used for sampling damp or especially dense granular materials, or even liquids, as the vacuum pump maintains a steady flow along the channel.

Although in this example the spear has one channel only, the invention could be embodied in a more complex arrangement of plural channels, with plural inlet apertures communicating via respective intermediate stores in the tip region with one or more outlets.

In this example, air inlet 13 communicates with free air, but it would be possible to connect it to means for applying an increased pressure if such increase were required to match the bulk material pressure at the point of its entry through aperture 18.

The probe in this example is spear-shaped with a pointed tip, but other shapes appropriate for sampling the material concerned could be adopted.

With reference now to figs. 5 - 8, an elongate hand probe comprises channel-shaped side frame members F, shown in Figure 7 but omitted from Figure 6 for the sake of clarity, which support a rectangular channel-section storage chamber C, extending over a major portion, about four-fifths, of the length of the frame member F.

The chamber C is open along a front elongate face, as shown in Figure 7, but this is closed by an endless belt in the form of a roller shutter B which covers the front and rear elongate faces. The shutter B is journalled on a free jockey wheel W2 in the tip, and a jockey wheel W1 driven by a crank handle H.

The chamber has semi-cylindrical end walls CT, CB.

A circular outlet, at the top of the chamber and to one side, communicates with an outlet spout O, which guides grain outwardly of the chamber C and also serves as a handle for the probe.

The shutter B has a single opening X, which is rectangular and in width is about 3/4 of the width of the shutter B. A collection/closure flap FL is hinged to the lower edge of the aperture at S, and a suitable stop prevents the flap from opening any further than about 45 degrees, as shown in Figure 6. The flap carries a transverse ridge plate R which serves to close the flap when the probe is plunged into the bulk material, or else the flap is curved as in Figure 8.

In use, the probe is emptied and is plunged tip first into the material, generally vertically downwards. This closes the flap FL and prevents any premature sampling. The handle H is turned if necessary to ensure that the aperture X is at its extreme position nearest the tip, below the base of the chamber CB. However, to ensure that there is no premature sampling, the aperture X may be moved below the base wall CB of the chamber before the probe is inserted.

The handle is then turned so as to raise the shutter so that the aperture X moves progressively over the exposed side of the chamber C. As the shutter commences its movement from the tip, the pressure of material on the projecting portion opens the flap FL to the well-defined 45 degree position, by the time the aperture X reaches the chamber C. As the shutter slides upwards, the flap FL scoops material from a vertical column adjacent the probe, guiding it through the aperture X. This ensures that particles of all sizes are sampled representatively: no material from that column is left behind. The rate of flow of sampled material will depend on its particle size, and the speed of advance of the shutter should be sufficiently slow to allow the material to enter the chamber at the appropriate level matching (approximately) the level in the column from which it originated.

The chamber, when filled, is then emptied into an appropriate vessel for analysis.

It will be appreciated that the projection of the flap FL should correspond to the width of the chamber C, in order that the chamber C should accommodate the column of sampled material.

The probe could be adapted for use with an automatic sampling machine, in which case it could be emptied by pneumatic transfer on the sample, whilst the driven wheel W is reversed to allow the flap to return the tip in readiness for the next sampling point in the bulk material. It may be necessary, in this case, to add springs to the flap FL to prevent it closing under the vacuum suction.

Where flour is to be sampled in particular, it may be advantageous to provide a vibration mechanism on the drive system to clean the probe between samples.

In the case of pneumatic sampling, whether manual or automatic, it is desirable to control the amount of suction at the sampling device so that it is large (nearly one atmosphere) when the device is full of the material, or when the intermediate store 17 of Figure 1 is full, but very small otherwise, so as to avoid any substantial pressure drop across the sample aperture. This may be ensured by the automatic pressure control device of Figure 9.

As shown in Figure 9, the sample channel 31,32 from the sampling probe to the vacuum pump and sampling analysis store has a T-junction with an air inlet pipe 33. The device 30 has an air outlet connected to the pipe 33, and comprises an air chamber with frusto-conical and cylindrical 34 walls, the cylindrical wall 34 closed partially by an end plug 36 with apertures 37. A closure piston 35 slides sealingly against the wall 34 along a rod 38 whose screw-threaded end is engaged in the end plug 36. The piston is biased into abutment with the end plug by means of a coil spring 40 over the rod 38, retained thereon by an end stop plate 39, whose spring force is adjustable by the screw-threading on the rod 38.

The cylindrical wall 34 has four paraxial slots 41 open to the atmosphere, which are progressively obstructed by the piston 35. As the piston 35 moves towards the outlet 33 against the spring bias, under the atmospheric pressure on its outer surface, the portion of each aperure 41 seen by the air chamber progressively decreases, thus increasing progressively the resistance to the flow of atmospheric air into the chamber and thus into the sampling channel 31,32. In this way, the device responds automatically to the amount of suction in the channel 31,32 to vary that suction by controlling air flow. If it senses low suction, ie a pressure close to atmospheric, it will allow a substantial air flow; the aperture areas are of such a size, and the spring force is such, that a slight increase in suction will cause a slight movement of the piston. For this to occur, the minimum air flow resistance of the device, with the air chamber at its maximum size, needs to be comparable with the air flow resistance of the sampling device when empty.

Claims

1. A pneumatic sampling probe for withdrawing a representative sample from bulk material into which the probe is inserted, comprising within an outer wall a channel for directing air along the probe to its tip and thence back along the probe to an outlet for connection to a vacuum pump and to a store for the sample, in which the wall has an aperture upstream of and close to the tip exposing the channel to the exterior of the probe for the ingress of the sample, the bent portion of the channel between the aperture and the tip constituting an intermediate store for the material to be sampled.

2. A probe according to Claim 1, in which the channel is U-shaped with its upstream and downstream sections divided by a baffle extending longitudinally beyond the aperture towards the tip, so that the intermediate store extends fully across the channel at its bent portion.

3. A probe according to Claim 1 or 2, in which the upstream section of the channel extends substantially the full length of the spear and terminates at an inlet port exposed to the atmosphere.

4. A method of withdrawing a representative sample from bulk material using a sampling probe according to any of Claims 1 to 3, comprising inserting the probe downwardly tip first into the material, allowing the material to flow under gravity through the aperture into the intermediate store, and simultaneously sucking air and the sampled material from the outlet while allowing air into the upstream section of the channel.

5. A method according to Claim 4, in which atmospheric air is simultaneously admitted into the upstream section of the channel so that the material enters the channel above the intermediate store of material without experiencing any significant pressure change, but experiences a smoothly decreasing pressure change as it passes downstream through the intermediate store to the downstream section of the channel.

6. A method of withdrawing a representative sample from bulk material using a sampling probe having a channel for the passage of air and an aperture exposing part of the channel to the exterior, comprising inserting the probe into the bulk material, allowing the material to flow under gravity through the aperture into an intermediate portion to form an intermediate store across the whole channel, and simultaneously sucking air and the sampled material from the intermediate store through the channel downstream of the aperture.

7. A method of withdrawing a representative sample from bulk materials using a pneumatic sampling probe having a channel for the passage of air and an aperture exposing part of the channel to the exterior, comprising inserting the probe into the

bulk material and withdrawing it therefrom, and allowing the sample to enter the aperture whilst the probe is moving steadily downwards and/or upwards, simultaneously maintaining a very small pressure difference across the aperture.

8. A sampling probe for bulk granular or powdered solid material, comprising an elongate body having a tip for facilitating insertion of the probe into the bulk material and having an internal storage chamber extending over a major portion of its length, and closed along one side by a shutter which is moveable lengthwise by means of an external drive, the shutter having a single aperture which opens the chamber to the bulk material at any one of a continuous range of positions along the full length of the chamber, such that steady movement of the shutter causes it to advance adjacent a column of the bulk material immediately adjacent and parallel to the shutter and to collect that column progressively in the chamber at a level corresponding to the level from which the material was collected.

9. A sampling probe for bulk granular or powdered solid material, comprising an elongate body having a tip for facilitating insertion of the probe into the bulk material and having an internal storage chamber extending over a major portion of its length, and closed along one side by a shutter which is moveable lengthwise by means of an external drive, the shutter having a single aperture which opens the chamber to the bulk material at any one of a continuous range of positions along the full length of the chamber, a collection/closure member connected to the shutter adjacent the edge of the aperture nearest the tip and pivotable between a closure position, at which it closes the aperture, and a collection position at which it projects transversely of the probe and is prevented from further movement outwardly of the probe body, the inclination of the collection/closure member at its collection position being such that insertion of the probe into the bulk material ensures closure of the collection/closure member, and the collection/closure member having a minor portion which still projects from the shutter at its closure position such that steady movement of the shutter from the end of the chamber nearer the tip to the opposite end ensures that the collection/closure member moves to its collection position and then collects progressively a column of the bulk material immediately adjacent and parallel to the shutter, the collected material being pushed by the collection/closure member through the aperture and into the chamber at a level corresponding to the level from which the material was collected.

10. A pneumatic sampling system for fluid material such as granular material, comprising a vacuum pump connected through a sampling channel to a sampling device and, intermediate the pump and the sampling device, a pressure control device comprising: An air chamber defined by a wall and having an air outlet connected to an inlet of the sampling channel, the wall having at least one opening to the atmosphere, the opening being capable of progressive closure by a closure member which is resiliently biased towards a first position at which the opening is unobstructed, and the closure member being responsive to a difference in pressure between the atmosphere and the chamber interior to move against such resilient bias towards a second position at which the opening is at least partially closed, causing aprogressive closure of the opening, whereby the resistance to air flow from the atmosphere to the sampling channel inlet increases progressively with a decreasing air pressure in the sampling channel.

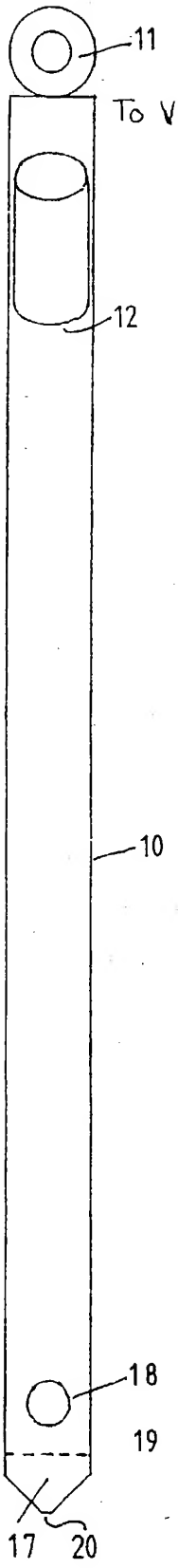
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FIG 1

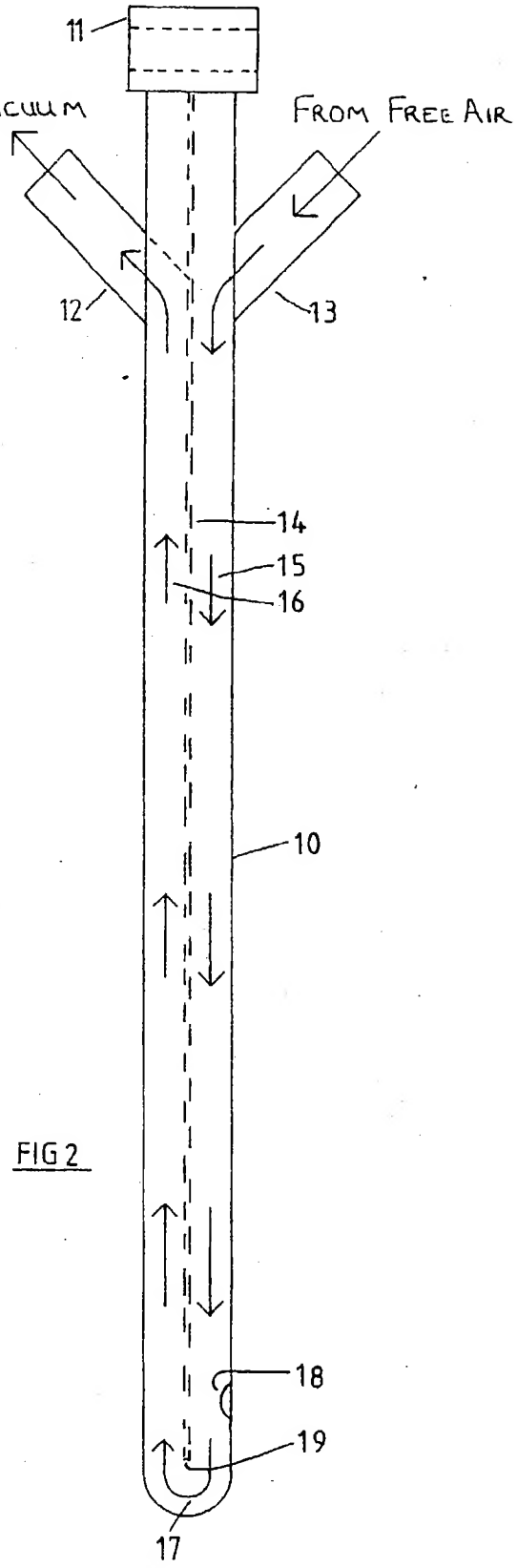
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FIG 2

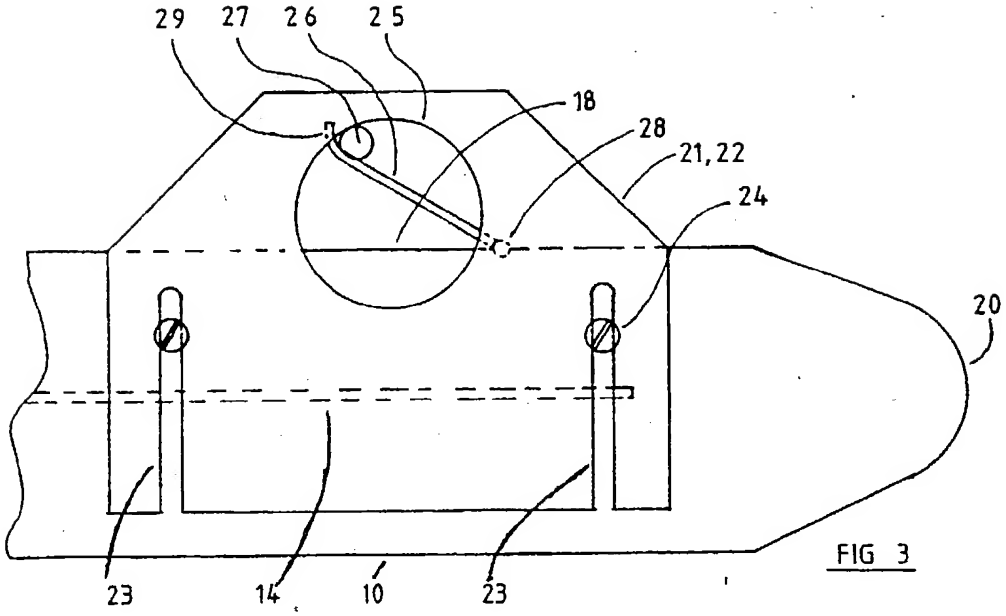
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FIG 3

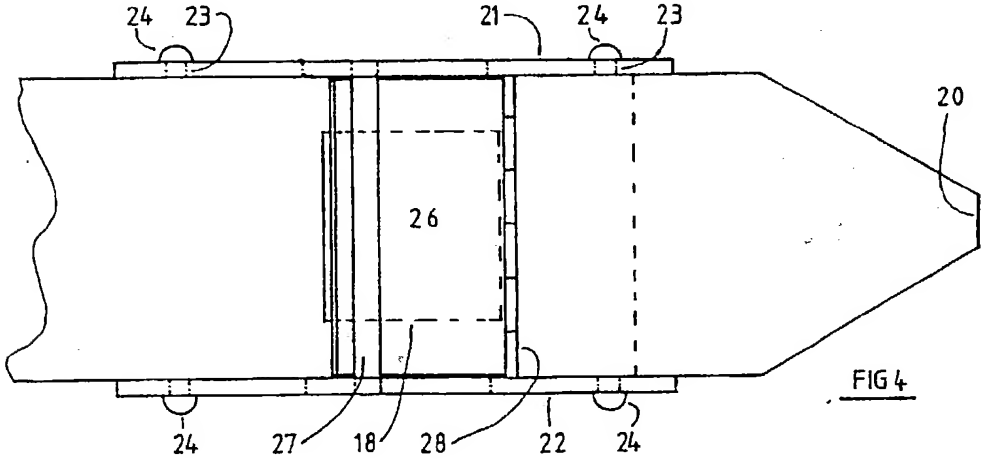
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FIG 4

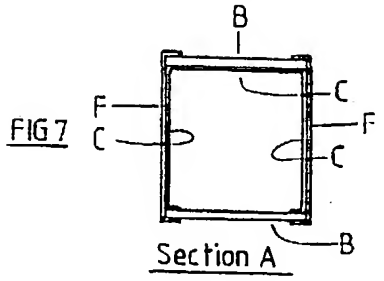

FIG 7

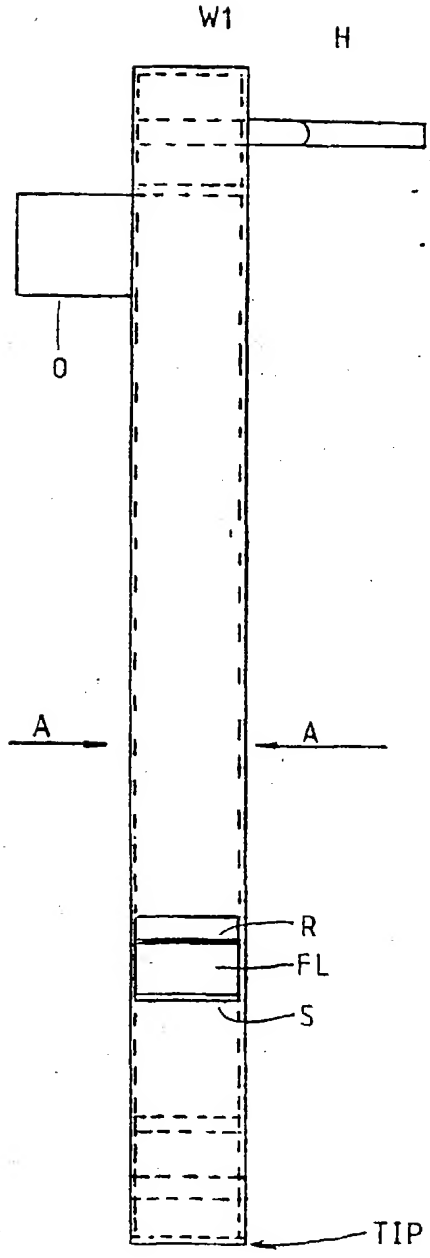

FIG 5

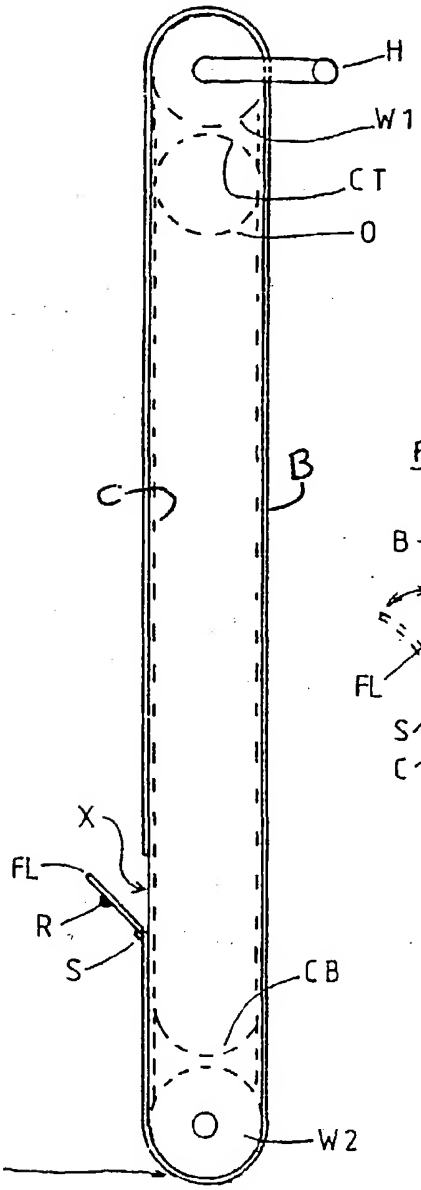

FIG 6

FIG 8

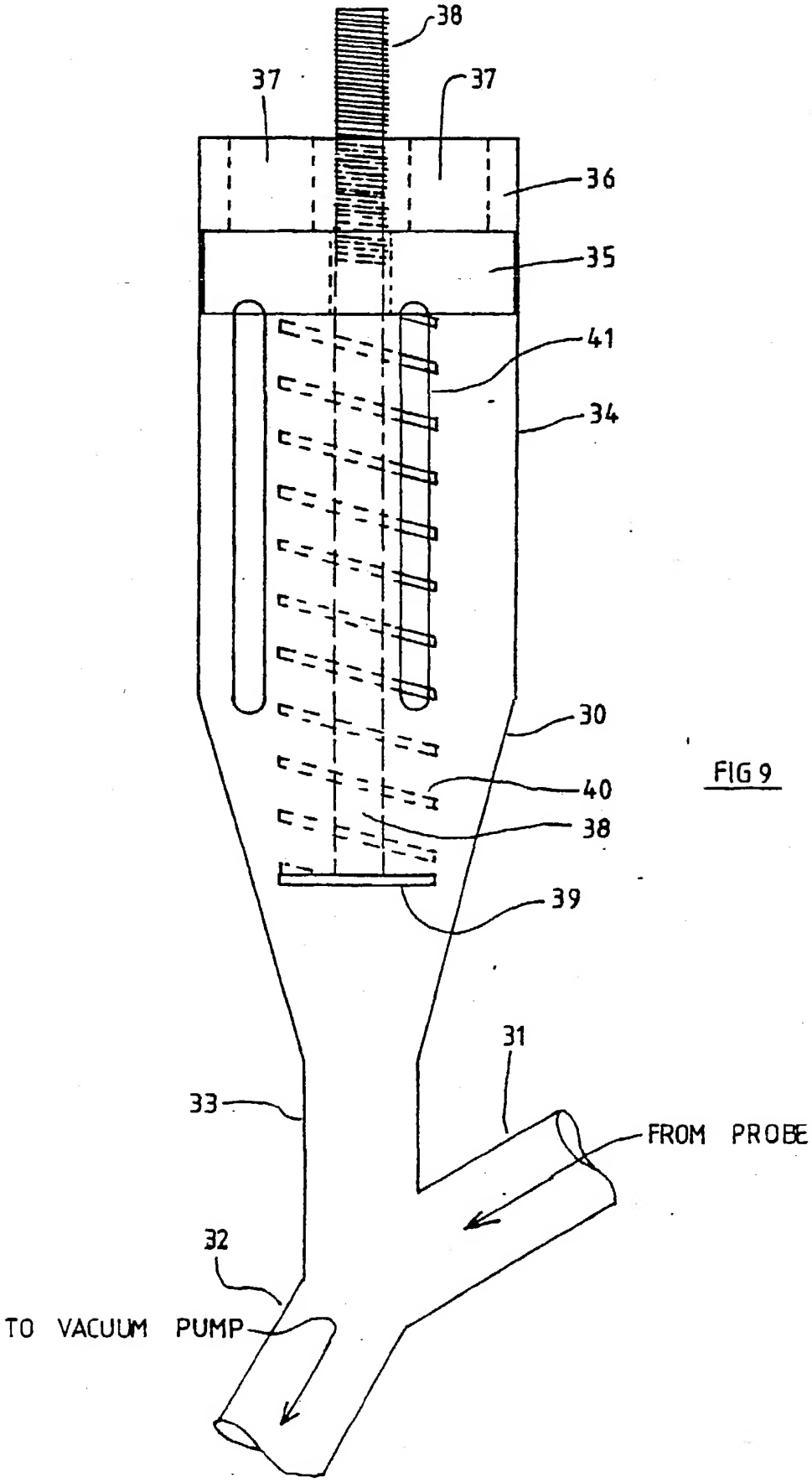

FIG 9

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 411 932 A3**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **90308483.8**

(51) Int. Cl.5: **G01N 1/08**

(22) Date of filing: **01.08.90**

(30) Priority: **02.08.89 GB 8917645**
06.04.90 GB 9007893

(43) Date of publication of application:
06.02.91 Bulletin 91/06

(84) Designated Contracting States:
DE DK FR IT SE

(88) Date of deferred publication of the search report:
11.03.92 Bulletin 92/11

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(54) Sampling probe.

(57) A pneumatic sampling probe for withdrawing a representative sample from bulk material (especially grain) into which the probe is inserted, comprising within an outer wall a channel for directing air at atmospheric pressure along the probe to its tip and thence back along the probe to an outlet for connection to a vacuum pump and to a store for the sample, in which the wall has an aperture upstream of and close to the tip exposing the channel to the exterior of the probe for the ingress of the sample, the bent portion of the channel between the aperture an the tip constituting an intermediate store for the material to be sampled.

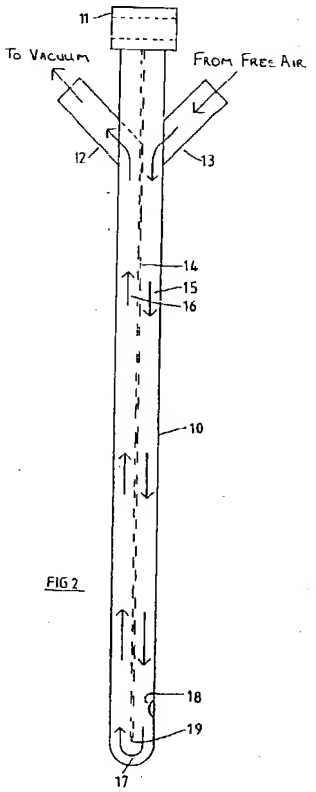

FIG 2

EP 0 411 932 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 90308483

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y,D	FR-A-2542086 (TRIPETTE & RENAUD) * page 1, lines 1-15; page 3, lines 21-25; page 5, lines 22-25 *	1-6	G01N1/08
Y	US-A-4088025 (B.D. FOSTER et al.) * abstract; claim 1 *	1-6	
X	US-A-4283946 (M.D. BOWSER et al.) * column 2, line 32 - column 3, line 50; column 5, lines 9-11 *	6	
A		1-5	
A	US-A-3580084 (H.A. KRAMER) * column 1, page 52 - column 2, line 30*	1	
A	EP-A-0251411 (K.K.B. KLIT) * column 3, lines 26-56 *	1	
A	US-A-4616515 (D. DANCOINE) * abstract *	1	TECHNICAL FIELDS SEARCHED (Int. Cl.5) G01N

The present search report has been drawn up for all claims 1-6

Place of search	Date of completion of the search	Examiner
BERLIN	25.06.1991	BRISON, O.P.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)

European Patent Office

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.

☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid,

namely claims:

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

X LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions.

namely:

1. claims 1-6
   pneumatic sampling probe and method for withdrawing a sample from bulk material

2. claim 7
   method of withdrawing a sample using a steadily downwards and upwards moving pneumatic sampling probe

3. claims 8,9
   sampling probe with shutter and external drive

4. claim 10
   pneumatic sampling system with resiliently biased closure member

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid.

namely claims:

☒ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims,

namely claims: 1-6